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BULLETIN

OF THE

TORREY BOTANICAL CLUB

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Vol. 49 No. 7

BULLETIN

OF THE

TORREY BOTANICAL CLUB

JULY, 1922

New species of Uredineae—XIV*

JOSEPH CHARLES ARTHUR

In the tenth article in this series of new species an error was made in the determination of the host for *Uromyces fuscatus* (Bull. Torrey Club **45**: 142. 1918), which should be *Rumex paucifolius* Nutt., and not "*Polygonum alpinum* All." as printed. It was due to the persistent efforts of Mr. A. O. Garrett, who first thought the host of the collection which he made was *Pentstemon* (see Fungi Utahenses *244*), that the facts in the case were finally established. In July, 1920, Mr. Garrett visited the Utah locality at Gogorza, where he first collected the rust in June, 1915, and secured a flowering stalk of the host, showing it to be *Rumex paucifolius*. Upon my presenting the situation to Professor Aven Nelson, he looked up the field notes and the herbarium specimens collected in Idaho at the same place and time as the type of *U. fuscatus* and came to the conclusion that the host of this collection also was *R. paucifolius*. Only these two localities for the species are known up to the present time.

The correction of these errors was complicated by a similar uncertainty and error in the host names for *Puccinia Polygoni-alpini* Cruch. & Mayor (*Dicaeoma Polygoni-alpini* Arth. N. Am. Flora **7**: 385. 1920), for which only two collections were known at that time, a third one having been added from Greenville, California, since the printing of the Flora. *Rumex paucifolius*, host of the *Uromyces*, can not be told from *Polygonum alpinum*, host of the *Puccinia*, when the fruiting parts are absent, hence the difficulties that have arisen.

* Contribution from the Botanical Department of Purdue University Agricultural Experiment Station.

[The BULLETIN for June (**49**: 163-188. *pl. 9*) was issued July 8, 1922]

In the twelfth article of this series, under *Puccinia offuscata* (Bull. Torrey Club **47**: 469. 1920), the name *Uredo Zorniae* Dietel (Hedwigia **38**: 257. 1899) should have been given as a synonym. This name was applied to Ule's *2296* from Brazil. Although pycnia have not been seen yet there is circumstantial evidence to indicate that no aecia are produced, and therefore the species is probably a *Bullaria*, and should be called **B. Zorniae** (Dietel) comb. nov. It is a species of the New World, to which the name *Puccinia Zorniae* McAlpine does not apply.

In the same article, under *Pucciniastrum americanum* (Bull. Torrey Club **47**: 468. 1920), *Rubus occidentalis* was erroneously given as a host for this species. The error was called to my attention by Dr. J. J. Davis of the University of Wisconsin, and was confirmed by subsequent examination under the microscope. The type of *P. arcticum americanum* Farl. is on *Rubus neglectus* Peck, collected at Bussey, near Cambridge, Massachusetts. This collection is first mentioned in the original article by Farlow (Rhodora **10**: 16. 1908) as on *R. occidentalis* near Cambridge, but later in the article is referred to as on *R. neglectus*, Bussey, October, 1875. The correction in the name of the host is credited to M. L. Fernald. I have been able to ascertain these facts through the assistance of Dr. R. Thaxter, who has carefully examined the original material in the Farlow Herbarium.

Melampsoropsis roanensis sp. nov.

II. Uredinia hypophyllous, in crowded groups of 2–8 on somewhat discolored spots, roundish or ovoid, 0.3–0.8 mm. long, prominent, early dehiscent by a central or lateral slit, leaving a border or a cap-like covering of epidermis, pulverulent; peridium delicate, uniform in thickness; urediniospores catenulate, ellipsoid, 20–26 by 32–40 μ; wall colorless, 1.5–2.5 μ thick, closely and finely verrucose on one side grading to coarsely verrucose on opposite side with somewhat deciduous cylindric tubercles, 2 μ long.

Telia hypophyllous, in irregular and often confluent groups on reddish spots, roundish or ovoid, 0.5–1 mm. across, elevated, prominent, waxy, orange-red, tardily naked; teliospores cuboid, 16–20 μ broad, almost or quite as long, in a series 65–100 μ long; wall colorless, thin, 1 μ, smooth; contents orange-red.

On *Rhododendron catawbiense* Michx. (Ericaceae), summit of Roan Mountain, Carter County, Tennessee, altitude 6400 feet, July, 1887, II, *R. Thaxter.*

On *Rhododendron punctatum* Andr., LeConte Mountain, Sevier County, Tennessee, altitude 6600 feet, June 8, 1921,

ii, III, *H. F. Bain*, communicated by John A. Stevenson *5812* (type).

The urediniospores of this interesting species are much larger and more prominently verrucose than those of the common form in Europe, *M.* (*Chrysomyxa*) *Rhododendri*. This is the first rust on *Rhododendron* seen from the eastern United States, although the European species has been ascribed to this country by a number of authors. Duggar says (Fungous Diseases 432. 1909), "In the United States this fungus is particularly common in the mountains of the east, and southward as far as the southern limits of the Appalachians." The statement does not apply to any true rust on *Rhododendron*. Roan Mountain and LeConte Mountain are about 100 miles apart. The rust was reported abundant on the summit of LeConte Mountain. Mycologists who visit the summits of these mountains and those nearby should be on the lookout for the aecia, which may be expected to occur on species of *Picea*.

Cronartium stalactiforme Arthur & Kern, comb. nov.

Peridermium stalactiforme Arth. & Kern, Bull. Torrey Club **33**: 419. 1906.

This *Cronartium* belongs to a group of three species which have been much confused, both in nomenclature and in structural characters. All three species have uredinia and telia on *Castilleja* and related genera of scrophulariaceous hosts, which are difficult to distinguish except by means of cultures. The aecia of the three species, however, occuring on pine trunks and branches, can be identified with considerable certainty, even by their gross appearance. The aecia of *C. stalactiforme* are confined to the bark and do not produce woody galls. They often extend over considerable areas, and cause little or no swelling. The individual aecia are low and flattened, with a circumscissile dehiscence.

Cronartium filamentosum (Peck) Hedgc. (*Peridermium filamentosum* Peck, 1882) is similar to *C. stalactiforme* in the effect upon the host, but the individual aecia are more elongated, often becoming cylindric, and have noticeable filaments extending from top to bottom through the individual aecia. There are only rudiments of such filaments in *C. stalactiforme*.

Cronartium coleosporioides (Diet. & Holw.) Arth. (*Peridermium Harknessii* Moore, 1876) differs from the two preceding species by producing a woody gall, often of considerable size and

abruptly rising from the healthy tissue. The individual aecia are low and coalesce into a more or less continuous mass, and are entirely without internal filaments.

There has been much confusion regarding the application of the name *Peridermium Harknessii*, owing in the first place to the obscure way in which it was first published*, and in the second place to the later inclusion of the Pacific Coast forms of the very similar *P. Cerebrum*, whose uredinia and telia occur on leaves of oak.

The name was announced at a meeting of the San Francisco Microscopical Society in July, 1876, by J. P. Moore, who exhibited specimens and explained the nature of the fungus, and who read a letter from H. W. Harkness describing the species in an informal but accurate manner. The collection to which the name was applied was made by Harkness and Moore on May 26, 1876, at Colfax, California, which is in Placer county,

* Our attention was directed to the early history of this name by Mr. E. Bethel in a letter dated January 22, 1922. Through the assistance of Mr. W. M. Hepburn, of the Purdue University Library, and Professor W. C. Blasdale, of the University of California, the following facts have been established.

In the minute book of the San Francisco Microscopical Society this record occurs: "July 20, 1876. Mr. J. P. Moore read a paper written by Dr. H. W. Harkness on a new variety of fungus infesting Pinus ponderosa near Colfax, and he proposed the name Peridermium Harknessii, which was adopted." There is also in the archives of the society a newspaper clipping giving a more extended account of the matter as presented to the society. This clipping, Professor Blasdale has ascertained, came from the issue of the Daily Alta California of San Francisco, of Saturday, July 22, 1876, volume 28. It consists of the Harkness paper in full, and a paragraph stating how Moore proposed the name.

The society did not issue any printed account of its proceedings during this period of its existence, but occasionally, as the subject matter warranted, the secretary transmitted a more or less formal minute to the London Monthly Microscopical Journal. In the issue of that journal for September 1, 1876, an account of the meeting of July 20 is given in the same words used in the newspaper clipping, with three additional paragraphs.

What is referred to as a paper by Dr. Harkness is in the form of a letter to the secretary of the society. It begins with the sentence: "I have today forwarded for the Society's Cabinet a specimen of Peridermium," etc. This type material was destroyed in the great San Francisco fire, being bulky and in a box separate from other type collections, as Mr. Bethel writes, who has consulted the herbarium of the society both before and since the fire, and as stated by Meinecke (Phytopathology **10**: 281. 1920), who also calls attention to the duplicate specimen at the New York Botanical Garden.

about fifty miles west of Lake Tahoe. Harkness says the fungus "appears both on the limbs and trunks of young trees of the variety *Pinus ponderosa*, generally forming a complete circle around the trees, its sporidia appearing as a zone of bright orange yellow. The spores first germinate beneath the cuticle, which it destroys. Owing to the irritation of this presence an abnormal thickening of the cambium is produced, which in turn gives place to an excessive growth of woody fibre. This process being repeated from time to time a large bulbous expansion is soon formed, so that as often occurs a stem of but an inch in diameter is enlarged to that of four or five. Above this bulb the further development of the stem is retarded, or arrested altogether, its place being supplied by a dense tuft of minute branches." Among other matters it is also stated that "in the vicinity of Colfax the fungus appears to be limited to an area of but a few acres in extent. Within that area, however, it is destroying the young growth."

The quotation is taken from the report by the secretary of the San Francisco society sent to the Monthly Microscopical Journal of London, and printed on page 164 in volume 16, bearing the date of September 1, 1876. This periodical was maintained by the Royal Microscopical Society.

The name, host and locality are cited in Harkness & Moore's Pacific Coast Fungi in 1880, still without confusion with any other form. But when Harkness published technical descriptions of "New species of Californian fungi" in the Bulletin of the California Academy of Science in 1884, other forms and hosts were incorporated, and from this time on the application of the name has been various.

The chief source of confusion has been in failing to recognize the Pacific Coast form of *Peridermium Cerebrum* Peck, which occurs along the coast of California, and is especially abundant at Monterey on *Pinus radiata* (*P. insignis*). The present writers feel especially culpable for this confusion, for they placed *P. Harknessii* under *P. Cerebrum* as a synonym in their paper on North American species of *Peridermium* on pine (Mycologia **6:** 133. 1914), and have been followed by Meinecke, in his paper on *Peridermium Harknessii* and *Cronartium Quercuum* (Phytopathology **6:** 225-240. 1916), and by others.

The present knowledge of the *Castilleja* rusts indicates that the correct application of the names should be as follows:

Cronartium filamentosum (Peck) Hedgc. (*Peridermium filamentosum* Peck, 1882);

Cronartium coleosporioides (Diet. & Holw.) Arth. (*Uredo coleosporioides* Diet. & Holw. 1893);

Cronartium stalactiforme Arth. & Kern (*Peridermium stalactiforme* Arth. & Kern, 1906).

Should it be deemed advisable to combine these three species as subspecies, races, or forms, the name to be employed for the aggregate species, using the oldest specific name, would be *Cronartium Harknessii* (Moore) Meinecke, Phytopathology **10:** 282. 1920.

DIABOLE gen. nov.

Cycle of development includes only subcuticular telia, with a possibility of pycnia.

Telia somewhat indefinite in extent, without paraphyses. Teliospores free, usually paired on a common pedicel, one-celled, more or less adhering laterally; wall colored, usually verrucose, at least above; pore one, in upper part of cell.

Diabole cubensis comb. nov.

Uromycladium (?) *cubense* Arth. Mem. Torrey Club **17:** 119. 1918.

The species occurs in Cuba on *Mimosa pigra* L. (*M. asperata* L.) and was at first assigned with many misgivings to the genus *Uromycladium*. That connection has become more and more uncertain, and it is now believed to constitute a new and very distinctive genus.

Puccinia Plucheae (Sydow) comb. nov.

Uredo Plucheae Sydow, Ann. Myc. **1:** 333. 1903.

Uredo biocellata Arth. Bull. Torrey Club **33:** 517. 1906.

Puccinia biocellata Vestergr. Micr. Rar. Sel. *1267*. 1908.

The teliospores of this rust have been collected on two hosts, *Pluchea fastigiata* Griseb. and *P. Quitoc* DC., in Argentina, and issued in Vestergren's exsiccati, Nos. 1267 and 1368. The rust occurs on a number of species of *Pluchea* in Florida, Guatemala and the West Indes, but no teliospores have yet been found in North America.

Uredo nominata sp. nov.

II. Uredinia amphigenous, grouped upon discolored areas, 5–10 mm. across, oblong or linear, 0.4–5 mm. long, somewhat

tardily naked, pulverulent, light-brown, ruptured epidermis evident; urediniospores ellipsoid or obovoid, 18–23 by 23–32 μ; wall light cinnamon-brown, 1.5–2 μ thick, moderately echinulate, the pores 3 or 4, approximately equatorial.

On *Sisyrinchium Bermudianum* L. (*Iridaceae*), St. Davids, Bermuda, February 26—March 9, 1908, *Stewardson Brown 611*. A number of rusts have been described on *Sisyrinchium*, both from North and South America, but representatives of them are rare and scanty in herbaria. Judging from descriptions and the small amount of material available this form should be considered distinct.

Uredo cumula sp. nov.

II. Uredinia amphigenous, somewhat aggregate or scattered, round, applanate, small, 0.1–0.4 mm. across, soon naked, pulverulent, cinnamon-brown, conspicuous, ruptured epidermis noticeable; urediniospores broadly ellipsoid or obovate, small, 18–20 by 22–25 μ; wall pale cinnamon-brown, thin, 1 μ or less, finely echinulate, the pores 2, equatorial, indistinct.

On *Buchnera elongata* Sw. (*Scrophulariaceae*), Herradura, Cuba, March 24, 1921, *John R. Johnston 2530*. The species is notable for its small delicate spores, although when massed on the surface of the plant they are of ordinary conspicuousness. The generic name of the host is sometimes written *Buechnera*.

Uredo curvata sp. nov.

II. Uredinia hypophyllous, loosely grouped on slightly discolored areas 3–5 mm. across, round, small, 0.1–0.3 mm. in diameter, soon naked, pulverulent, dark chestnut-brown, ruptured epidermis inconspicuous; paraphyses numerous, peripheral, incurved, hyphoid or somewhat clavate, slender, about 7 by 30 μ, the wall thin, less than 1 μ, slightly thicker above, 1–2 μ, colorless below, light chestnut-brown above, sometimes one- or two-septate; urediniospores obovate, 14–16 by 26–32 μ, very strongly curved; wall chestnut-brown, uniformly thin, 1 μ, with one indistinct pore on the concave side below the equator, evenly echinulate-verrucose.

On *Inga vera* Willd. (*Mimosaceae*), San Diego de los Baños, Cuba, March 26, 1921, *John R. Johnston 2540*. The species is remarkable for its very much curved spores with one pore on the indented side, being in this respect similar to the uredinia of *Puccinia invaginata* Arth., which occurs in Cuba on the rhamnaceous genus *Gouania*.

Aecidium Yuccae sp. nov.

O. Pycnia amphigenous, in small and crowded groups, inconspicuous, honey-yellow, subepidermal, small, globoid,

80–115 μ in diameter; ostiolar filaments prominent, 45–65 μ long, agglutinated into a column.

I. Aecia amphigenous, irregularly arranged in loose groups, cylindric, 0.3–0.5 mm. in diameter and somewhat higher; peridium firm, erect, the margin finely erose; peridial cells angularly globoid or ellipsoid in face view, rectangular or somewhat rhomboidal in section, 16–18 by 23–35 μ, abutted or slightly overlapping, the outer wall 3–5 μ thick, smooth, the inner wall thinner, about 2 μ, finely verrucose; aeciospores globoid or broadly ellipsoid, 16–20 by 19–24 μ; wall colorless, thin, 1 μ or less, very closely and finely verrucose.

On *Yucca glauca* Nutt. (*Dracaenaceae*), Crawford, Nebraska, June 28, 1921, *A. O. Garrett.* An interesting species, as it comes from the semi-arid, sandhill region, where a number of grass rusts of restricted range occur, to one of which it undoubtedly is genetically connected. Only a few groups of aecia on the upper part of a young leaf were secured by Mr. Garrett, who kindly submitted all the material for study.

PURDUE UNIVERSITY,
LAFAYETTE, INDIANA

Studies in the genus Lupinus—VII. L. succulentus and L. niveus.

CHARLES PIPER SMITH

(WITH FOUR TEXT FIGURES)

INTRODUCTION

In accounting for the North American annuals and biennials of the subgenus *Lupinus*, I have found it advisable to recognize six groups, as indicated and contrasted in the key below. These groups, however, do not provide for the Mexican annuals, *L. bilineatus* Benth., *L. Hartwegi* Lindl., and *L. Barkeri* Lindl., nor for the Costa Rican *L. Clarkei* Oersted, as satisfactory material of these species has not been available for my study.

Keel petals ciliate on their lower edges near the claw, commonly ciliate above, also, near the claw.
- Racemes shorter than their peduncles. — STIVERSIANI.
- Racemes longer than their peduncles.
  - Flowers verticillate; leaflets glabrous above. — SUCCULENTI.
  - Flowers scattered; leaflets more or less hairy above. — SPARSIFLORI.

Keel petals non-ciliate on their lower edges.
- Keel petals ciliate above near the point. — MICRANTHI.
- Keel petals non-ciliate on both upper and lower edges.
  - Flowers verticillate; leaflets hairy above. — MICRANTHI.
  - Flowers with scattered
    - Leaflets hairy above, 2–5 mm. wide; pods 10–15 mm. long; seeds 1.5–3 mm. long. — CONCINNI.
    - Leaflets glabrous above, 6–12 mm. wide; pods 30–50 mm. long; seeds 4–6 mm. long. — SUBCARNOSI.

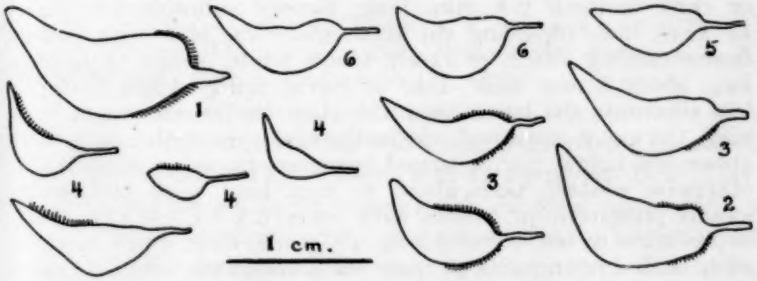

FIG. 75. 1. STIVERSIANI; 2. SUCCULENTI; 3. SPARSIFLORI; 4. MICRANTHI; 5. CONCINNI; 6. SUBCARNOSI.

FIG. 75 is here inserted to emphasize and contrast the above

indicated variations in the keel. Four of these groups, namely, the *Sparsiflori*, *Stiversiani*, *Concinni*, and *Subcarnosi*, have been treated in the last two papers of this series (Bull. Torrey Club **47**: 487-509. 1920; **48**: 219-234. 1921). This paper will consider the *Succulenti* and one species of the *Micranthi*.

SUCCULENTI

The one species included here is so distinct from all the other annuals of our region that I do not feel justified in placing it in any of the other groups recognized. The ciliation of the keel is too constant to be ignored, though nowhere properly described. This is the group some years ago indicated by me under the name *Affines* (Muhlenbergia **6**: 134. 1911).

1a. LUPINUS SUCCULENTUS Dougl.; C. Koch, Wochenschrift Gaertn. Pflanzenkunde **4**: 277. 1861. [FIG. 76.]

Stout, succulent or fistulous, 2–6 dm. tall, branched, nearly glabrous or sparsely appressed-pubescent (rarely villous): leaves several; petioles slender, 6–12 cm. long, one to three times as long as their leaflets, stipules linear-setaceous, 10–12 mm. long, the free part widely divergent; leaflets seven to nine, cuneate or cuneate-obovate, rounded, truncate, or emarginate at apex, usually apiculate, glabrous above, sparsely appressed-pubescent beneath, 20–70 mm. long, 6–16 mm. wide; peduncles 2–8 cm. long, racemes 6–30 cm. long, flowers subverticillate in about four to eight whorls or groups, spreading in anthesis, becoming ascending upon withering, 12–17 mm. long; bracts early deciduous, linear, 6–10 mm. long; pedicels spreading-pubescent with very short hairs, 4–6 mm. long; calyx bracteolate, subappressed-pubescent, the upper lip deeply two-toothed or bifid, about 5 mm. long, the lower lip lanceolate, entire and acute or three-toothed, 7–8 mm. long; banner suborbicular, about 14 x 13 mm. including the claw, glabrous, blue with yellow center turning violet, or rarely bluish white, wings 12–14 mm. long, about 8 mm. wide, blue or rarely nearly white, more or less ciliate at the base above the claw, keel stout, 12–14 mm. long, the point upturned, distinctly ciliate near the claw both above and below, purple-tipped or orange-tipped in the albinos, otherwise whitish; pods about 50 mm. long, 9–10 mm. wide, loosely pubescent or villous with hairs 0.5 to 1.5 mm. long, ovules eight to ten; seeds oblong, 3.5–5 mm. long, much marbled with dark brown, with a pair of contiguous whitish spots embracing the raphe, the hilum deeply sunken in a protruding ring: axial root normally vertical.

This is the plant that has been known as *L. affinis* Agardh, since Watson reviewed the genus in 1873 (Proc. Am. Acad. **8**: 517), but the specimens so marked in the Lindley Herbarium

(now at Cambridge University, England) are not this species. Indeed, Dr. Greene, in 1891 (Flora Franciscana 1: 40), expressed doubt that our robust, succulent annual is the true *L. affinis*, and I have long felt that Agardh's description does not satisfactorily apply to same. It remained, however, for Miss Alice Eastwood to unearth the needed evidence, and her photograph of Lindley's specimen labelled *L. succulentus* shows said specimen to be of this species. Likewise, her photographs of the specimens labelled *L. affinis* Agardh show equally well that same should not be referred to this robust species, but rather to *L. nanus*, a species which will be treated in a later paper. These are the conclusions arrived at by Miss Eastwood with the specimens before her.

Koch knew the species as a garden plant under the name *L. succulentus* and quotes Biedenfeld's Garten Jahrbuch as his

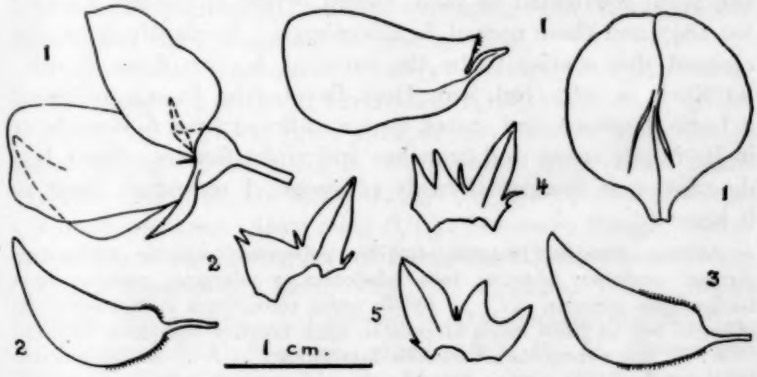

FIG. 76. LUPINUS SUCCULENTUS Dougl. 1. *C. P. Smith 1406* (CPS); 2. *K. Brandegee* (UC 81964); 3. *Edna Hannibal* (DS 87569); 4. *L. R. Abrams 4224* (DS); 5. *K. Brandegee* (UC 187796).

only authority for attributing the name to Douglas. He also states that the same species was distributed from Darmstadt as *L. Liebmanni* and from Geneva as *L. purpureus* Del. Considering the species to be undescribed, he drew up in 1861 a description in German, accrediting the species to Douglas and suggesting that its native home must be assumed to be California or Oregon. As his description is not readily available in this country, it is reproduced here:

Die ganze, mehr neidrig bleibende Pflanze ist mit Ausnahme der Oberfläche der Blätter sehr fein behaart; 9 länglichkeilförmige Blättchen mit zurückgebogener Spitze; Nebenblättchen wenig angewachsen, borsten-

förmig, aufrecht; Aehre gestielt, kurz, aus wenigen (meist nur 3) Quirlen bestehend; Deckblätter länger als die Knospen; Deckblättchen klein und oft undeutlich; Oberlippe 2 theilig, kürzer als die ganze Unterlippe; Schiffchen an der Basis des Randes gewimpert.

Diese durch ihre dunkelen, schwarzvioletten Blüthen ausgezeichnete und sehr zu empfehlende Art scheint noch gar nicht beschrieben zu sein. Obwohl Douglas als Autor angegeben ist und man vermuthen muss, dass Kalifornien oder das Oregon-Gebiet Vaterland sind, so haben wir den Namen doch nur in Biedenfeld's Garten Jahrbuche (im 1. Hefte S. 292) gefunden. Aus welcher Zeitschrift der Verfasser die Pflanze entlehnte, wissen wir nicht. Neuerdings ist sie weider aus dem Darmstädter botanischen Garten als L. L i e b m a n n i, aus dem Genfer als L. p u r p u r e u s Del. verbrietet worden. Wir vermuthen, dass die Namen in dem Verzeichnisse irgend eines botanischen Gartens aufgestellt wurden.

Koch also here recorded his opinion that the species seems to be related to *L. arvensis* Benth. and to *L. ramosissimus* Benth., a Colombian species collected by Hartweg, and especially to the plant illustrated in plate eleven of the Botanical Register for 1847 and there named *L. Ehrenbergii*. Evidently some one claimed this species to be the same as *L. densiflorus* Benth.; for Koch, in 1867 (Ind. Sem. Hort. Berol., App. 1: 11), published a Latin diagnosis and stated that it differed from *L. densiflorus* in its fragile stems and branches and violet flowers. Since this description is likewise difficult of access, I reproduce most of it here:

Annuus, humilis, ramosus, fragilis, puberulus; stipulae setiformes, erectae, paululum adnatae; folia 9-foliolata, 3-pollicaris; petiolus longitudine folia aequans; . . . foliolis supra glaberrimus subtus puberulis oblongis, sed ad basin magis attenuatis, apice breviter cuspidato, recurvo; . . . spica verticillata, verticillis distantibus; . . . labium superius bifidum, inferius lanceolatum, integrum; . . . vexillum et alae violaceae, . . . carina albida, ad partem superiorem violacea, apice flavescente; legumen pilosum, inter semina constrictum.

Species per longum tam tempus in hortis culta e California nec non e terris mexicanis sine dubio allata, accredit ad *L. densiflorus* Benth., differt tamen fragilitate caulis ramosumque et floribus violaceis. Nusquam descripta esse videtur, sed nupperime iterum in hortis botanicis nominibus: Lupini Liebmannii et purpurei occurrit.

There is a sheet of this species, marked "*Lupinus succulentus* Douglas, 1843", in a large old collection of European garden plants recently secured by Stanford University. Thus, I consider it advisable to accept this name for this species, which otherwise is without a proper botanical name. Douglas could hardly have overlooked the species during his sojourn in California, and certainly a more appropriate name could not be found. I cannot

follow Watson (Proc. Am. Acad. **8**: 538. 1873; and Bib. Index 236. 1878) in assuming that this "is probably but a garden form" of *L. densiflorus*, nor accept his application of Agardh's name to this species. Koch might have said more about the pods and seeds, but his "legumen . . . inter semina constrictum" and his comparison of the species with *L. arvensis*. *L. ramosissimus*, and *L. Ehrenbergii* do not point to a confusion with *L. densiflorus*.

The species is so common in the San Francisco Bay region that I will omit citation of many specimens examined. An albino form (petals pale bluish white) was common in 1921, in and near the mouth of Alum Rock Canyon, Santa Clara County. This was mostly in pure patches, but sometimes associated with pale blue, or the normal, dark blue, form. Seeds were secured from marked colonies, but those from the palest-flowered plants were heavily pigmented, perhaps averaging even darker, rather than paler, than is normal for the species.

CALIFORNIA. Alameda County: Berkeley, Feb., 1899, *H. P. Chandler 239* (UC); Livermore, April, 1904, *A. A. Heller 7320* (B, UC); Niles, June, 1918, *H. A. Walker 5006* (UC); Sunol Valley, June, 1916, *L. R. Abrams 5699* (DS). Butte County: Chico, *A. A. Heller 12983* (UCX). Colusa County: College City, 1905, *Alice King* (UC); Sycamore Slough, Sacramento River, April, 1917, *R. S. Ferris 621* (DS). Contra Costa County: Brentwood, May, 1893, *A. Eastwood* (CA); Bryon Springs, March, 1914, *A. Eastwood* (CA); Concord, March, 1914, *A. Eastwood* (CA); Martinez, April, 1862, *W. H. Brewer 996* (UC). Fresno County: Alcalde, March, 1892, *T. S. Brandegee* (CA); Alcalde, March, 1893, *A. Eastwood* (CA); Huron, March, 1893, *A. Eastwood* (CA). Kern County: Sunset Oil Wells, March, 1893, *A. Eastwood* (CA). Los Angeles County: Avalon, Santa Catalina Island, May, 1920, *G. L. Moxley 732* (CPS); Claremont, April, 1904, *C. F. Baker* (CA); Elysian Hills, Feb., 1903, E. Braunton (UC); Los Angeles, April, 1901, *E. D. Palmer* (UC); Redondo, San Pedro Hills, March, 1903, *L. R. Abrams 3141* (DS); Santa Catalina Island, May, 1916, *K. Brandegee* (UC). Monterey County: Carmel-by-the-Sea, March, 1910, *Alice D. Randall* (DS); Castroville, *T. S. Brandegee* (CA); Jolon Grade from King City, April, 1920, *C. D. Duncan 78* (DS); Pacific Grove, Pebble Beach, April, 1909, *L. R. Abrams 4224* (DS); Posts, June, 1893, *A. Eastwood* (CA). Riverside County:

Hemet, May, 1904, *C. F. Baker 4189* (UC, DS). Sacramento County: Sacramento, April and May, *Edna Hannibal* (DS). San Benito County: Idria, May, 1893, *A. Eastwood* (CA); San Benito, May, 1918, *A. Eastwood* (CA). San Bernardino County: San Bernardino, April, 1888, *S. B. & W. F. Parish* (UC), and March, 1901, *S. B. Parish* (DS). San Diego County: Campo, April, 1920, *A. Eastwood* (CA); La Jolla, April, 1903, *T. S. Brandegee* (UC), and March, 1914, *F. E. & E. S. Clements* (UC); Linda Vista, May, 1894, *T. S. Brandegee* (UC); Point Loma, April, 1913, *A. Eastwood* (CA); San Diego, June, 1885, *Fanny E. Fish* (UC), and March, 1889, *C. R. Orcutt* (CA), also April, 1905, *K. Brandegee* (DS, UC). San Francisco County: Twin Peaks trail, April, 1921, *Bertha Dold 105* (CPS). San Joaquin County: Tracy, April, 1903, *C. F. Baker 2908* (CA). San Luis Obispo County: San Luis Obispo, May, 1882, *M. E. Jones* (CA), April, 1886, *M. Miles* (CA), July, 1911, *K. Brandegee* (UC), and June, 1914, *C. P. Smith 2851* (CPS); San Luis Valley, March, 1882, *Mrs. R. W. Summers* (UC). San Mateo County: Crystal Springs Lake, April, 1896, *A. Eastwood* (UC); Portola, May, 1903, *A. D. E. Elmer 4827* (CA, DS); La Honda summit, May, 1900, *W. R. Dudley* (DS); San Mateo ravine, April, 1894, *W. R. Dudley* (DS); San Pedro, June, 1903, *A. D. E. Elmer 4681* (CA, DS). Santa Barbara County: Ellwood, May, 1908, *A. Eastwood 2* (CA); Santa Cruz Island, April, 1888, *T. S. Brandegee* (UC), July-Aug., 1886, *E. L. Greene* (CA), and June, 1918, *A. Eastwood* (CA); Santa Maria River, June-July, 1906, *A. Eastwood 329* (CA). Santa Clara County: Alum Rock Park, April, 1907, *A. A. Heller 8471* (CPS, DS), Feb., 1921, *C. P. Smith 3212*, albino, and *3213*, normal colored (CPS); Loma Prieta, April, 1894, *J. B. Davy 631* (UC); Los Altos, April, 1894, *W. R. Dudley* (DS); Saratoga, June, 1915, *L. R. Abrams 5260* (DS); Stanford University, April, 1903, *A. D. E. Elmer 4920* (CA, DS), and May, 1902, *C. F. Baker 858* (CA, UC); Campbell, March, 1921, *Claribel Boesch 101* (CPS); Evergreen, March, 1921, *Lotta Bland 101* (CPS); Madrone Packwood School, April, 1921, *Mrs. A. F. Cochrane 102* (CPS). Santa Cruz County: Chittenden, April, 1921, *C. P. Smith 3259* (CPS); Ellicott, June, 1908, *C. P. Smith 1455* (CPS). Shasta County: Anderson, April, 1914, *L. E. Smith 139* (CA). Solano County: Cordelia, April, 1902, *Heller & Brown 5369* (B, DS); Vacaville, May, 1891, *W. L. Jepson* (DS), and May, 1903, *C. F. Baker 5071* (DS, UC). Sonoma

County: Petaluma Valley, April, 1908, *C. P. Smith 1382* (CPS). Sutter County: Marysville Buttes, April, 1915, *A. A. Heller 11,792* (CA, DS, UCX); West Butte, April, 1917, *R. S. Ferris 690* (DS); Yuba City, April, 1891, *W. L. Jepson* (UC). Tehama County: Red Bluff, May, 1914, *L. E. Smith 670* (CA). Ventura County: Ojai Valley, April, 1896, *F. W. Hubby 41* (UC). Yolo County: Davis, April, 1915, *P. B. Kennedy 21* (UCX); Yolo, June, 1914, *C. P. Smith*, seed only (CPS).

LOWER CALIFORNIA. Carysito, April, 1885, *C. R. Orcutt* (CA).

ARIZONA. Gila County: Roosevelt Dam, April 1917, *A. Eastwood 6286* (CA), and May, 1919, *A. Eastwood* (CA).

The distribution of this plant is thus seen to be from Shasta County to northern Lower California, the occurrence at Roosevelt Dam, Arizona, being certainly due to a casual introduction of seed from California. Variations are not particularly well-marked, except in two cases, as indicated below:

1b. **Lupinus succulentus Layneae** var. nov.

Humilis ramis decumbentibus, villosus pilis pandentibus 2 mm. longis, leguminibus aeque villosis.

Depressed, 1 dm. tall, with decumbent branches and short racemes, densely villous with hairs 2 mm. long even on the pods.

CALIFORNIA. San Mateo County: Farallon City, June, 1918, *K. Brandegee* (TYPE, UC 187796).

Mrs. Brandegee's maiden name was Mary Katharine Layne.

1c. **Lupinus succulentus Brandegeei** var. nov. [FIG. 77.]

Humilis, erectus, foliolis maximis prope 20 mm. longis, floribus 9-10 mm. longis, vexillo 10 mm. longo, 7.5 mm. lato, alis apice non truncatis, carina ad basin super paulum ciliata.

Much reduced in stature and size of flowers; about 1 dm. tall, largest leaflets about 20 mm. long, flowers 9-10 mm. long, banner about 10 x 7.5 mm., wings not truncate at the apex, keel less ciliate above.

LOWER CALIFORNIA. Comondu, Feb., 1889, *T. S. Brandegee*

FIG. 77. LUPINUS SUCCULENTUS BRANDEGEEI C. P. Smith. *T. S. Brandegee* (UC 83498).

(TYPE, UC 83498); San Julio, April, 1889, *T. S. Brandegee* (UC), and April, 1919, *T. S. Brandegee* (CA).

MICRANTHI

L. micranthus and its nearest relatives comprise the largest and most difficult group of the annual species of the subgenus *Lupinus* Watson. Variations in shape and size of flowers, leaflets, pods, and seeds produce conspicuous extremes which have suggested "new species" not a few in number. That botanists have appreciated these variations is evidenced by the following list of published names:

L. bicolor Lindl. Bot. Reg. **13**: *pl. 1109*. 1827.
L. micranthus Dougl.; Lindl. Bot. Reg. **15**: *pl. 1251*. 1829.
L. nanus Dougl.; Benth. Tran. Hort. Soc. II. **1**: 409. 1835.
L. affinis Agardh, Syn. Gen. Lup. 20. 1835.
L. Aschenbornii S. Schauer, Linnaea **20**: 739. 1847.
L. micranthus microphyllus Wats. Proc. Am. Acad. **8**: 535. 1873.
L. niveus Wats. *ibid.* **11**: 126. 1876.
L. trifidus Torr.; Wats. *ibid.* **12**: 250. 1877.
L. chihuahuensis Wats. *ibid.* **21**: 423. 1886.
L. carnosulus Greene, Bull. Cal. Acad. **2**: 144. 1886.
L. umbellatus Greene, *ibid.* **2**: 145. 1886.
L. pachylobus Greene, Pittonia **1**: 65. 1887.
L. polycarpus Greene, *ibid.* **2**: 171. 1888.
L. rostratus Eastwood, Proc. Cal. Acad. II. **6**: 424. *pl. 56*. 1896.
L. persistens Heller, Muhlenbergia **2**: 62. 1905.
L. vallicola Heller, *ibid.* **4**: 40. 1908.
L. apricus Greene, Leaflets **2**: 67. 1910.
L. vallicola apricus C. P. Smith, Muhlenbergia **6**: 135. 1911.
L. hirsutulus Greene, Leaflets **2**: 152. 1911.
L. sabulosus Heller, Muhlenbergia **7**: 9. 1911.
L. Pipersmithii Heller, *ibid.* **7**: 93. 1911.
L. strigulosus Gandoger. Bull. Soc. Bot. France **60**: 461. 1913.

In addition to accounting for these published names, the scope of these papers will necessitate disposing of some seven herbarium names. Of the above, only one species will be treated at this time, the remainder being scheduled for attention in subsequent papers.

The name *Bicolores* would have been a more appropriate appellation for this group; but the name here employed has been in use for some time. The flowers measure 6–16 mm. in length and are always bicolored but are certainly not always small. They are usually verticillate; but the racemes are sometimes reduced to one umbel-like whorl, and in one form the flowers are strictly scattered. The keel is normally ciliate on the upper

margin near the point, a character not shared by any other group of North American annual lupines; however, two of the forms lack this ciliation. The upper surface of the leaves is almost always with at least a few short hairs.

2. LUPINUS NIVEUS Wats. Proc. Am. Acad. 11: 126. 1876. [FIG. 78.]

Apparently annual or biennial with persistent petioled cotyledons, erect, 3–4 dm. tall, branched well above the base, densely velvety tomentose above the cotyledons, which are fleshy, glabrous, the blades about 20 mm. long, 12 mm. wide: leaves velvety on both sides, petioles 6–8 cm. long, leaflets eight or nine, rounded or angled at the apex, 30–40 mm. long, 9–12 mm. wide: peduncles 5–8 cm. long, racemes 8–12 cm. long, loosely few-flowered, bracts deciduous, linear, 5–8 mm. long; flowers 10 mm. long, spreading or subdrooping, pedicels 4–6 mm. long; calyx practically ebracteolate, the lips equal in length, about 5 mm. long, the upper cleft or bifid, over 4 mm. wide, the lower bluntly two-toothed, barely 3 mm. wide. petals broad, deep blue, banner suborbicular, about 10 x 10 mm., greenish

FIG. 78. LUPINUS NIVEUS Wats. *E. Palmer 861* (G, US).

yellow in the center, wings about 10 x 7 mm., only slightly ciliate on the upper margin near the very sharp upturned point; pods yellow, 40–50 mm. long, 8–10 mm. wide, stout, ovules four or five; seeds pale, obscurely spotted, mostly 5–6 mm. long.

This is a very distinct, isolated, insular species not closely related to any other known species; but as I see it, better lined up with *L. nanus*, at least for the present. For a long time I was misled by Watson's clause, "allied to *L. leucophyllus*", and thus had difficulty in classifying this plant.

LOWER CALIFORNIA: Guadelupe Island, 1875, *E. Palmer 25*. (G); 1889, *E. Palmer 861* (G, US); 1893, *F. Franceschi* (US).

My thanks are especially due to Miss Alice Eastwood for the use of unpublished notes and to Dr. J. H. Barnhart for important bibliographical help.

The abbreviations used herein in the citation of specimens may be identified by reference to the following list:

B, Brooklyn Botanic Garden;
CA, California Academy of Science;
CPS, private herbarium of the writer;
DS, Dudley Herbarium, Stanford University;
G, Gray Herbarium, Harvard University;
UC, Department of Botany, University of California;
UCX, Division of Agronomy, University of California Experiment Station;
US, United States National Herbarium.

SAN JOSE, CALIFORNIA

A new American fossil hepatic

MARSHALL A. HOWE AND ARTHUR HOLLICK

(WITH ONE TEXT FIGURE)

Fossil Hepaticae are among the rarest of known paleobotanical remains. The total number of described species is less than twenty. Of these more than half are identifiable as living species of Jungermanniaceae, all but one of which are represented merely by fragments enclosed in amber of recent geologic age, found in the Old World. The remainder probably all belong in the Marchantiaceae.

Three species only have been heretofore recorded from America,* all of which are referable, either definitely or provisionally, to the latter family. It should be remarked, however, that the identity, as well as the botanical relationship of the species last cited, in our footnote, is questioned by Fontaine, who says (*l. c.*, p. 54): "It is similar to that of a *Brachyphyllum* and the plant may be really a twig of that conifer." Incidently it may also be remarked that this is the only species recorded for any geological horizon older than Tertiary, and that the type of the species, from the Jurassic of England, was originally described as an alga under the name *Fucoides erectus* Bean.†

Several years ago a collection of fossil plant remains from Florissant, Colorado, was sent by Mr. T. D. A. Cockerell to the New York Botanical Garden for examination. Among them was what appeared to be a fragment of a bryophyte; but it was so small and imperfectly defined that it was not identified, even as to its probable class relationship, until an enlarged photograph (FIG .1) was made. The specimen evidently represents a

*(a) *Preissites Wardii* Knowlton, Bull. Torrey Club **21**: 458. *pl. 219.* 1894. Eocene (Fort Union formation), Burn's Ranch, thirty miles from Glendive, Montana.

(b) *Marchantia Pealei* Knowlton, Proc. U. S. Nat. Mus. **35**: 157. *pl. 25.* 1908. Eocene (Lance formation), Custer County, Montana.

(c) "*Marchantites erectus* (Bean) Seward?", *fide* Fontaine in Ward, Monog. U. S. Geol. Survey **48**: 53. *pl. 6, f. 1, 2.* 1905. Jurassic, Douglas County, Oregon.

†In Leckenby, Quart. Jour. Geol. Soc. London **20**: 81. *pl. 11, f. 3a, 3b* (erroneously numbered *2a, 2b* on the plate). 1864.

member of the Bryophyta and probably belongs to the family Jungermanniaceae of the class Hepaticae.

Jungermanniopsis gen. nov.

Plants slender and minute, consisting of stem and leaves and showing a pronounced dorsiventrality, with ventral (postical) roothairs and dorsal (antical) apparently one-ranked but probably two-ranked ovate-acuminate, often subfalcate, assurgent or subvertical (antically secund) leaves and with occasional indistinct suggestions of much smaller lateral lanceolate or ligulate leaves.

Jungermanniopsis Cockerellii sp. nov.

Stem ascending at apex; leaves 1–1.5 mm. long, 0.4–0.7 mm. in maximum width, contiguous, narrowly spaced, or slightly overlapping at extreme base, the intervals between the leaves commonly resembling the outlines of inverted leaves, the often subfalcate acuminations directed forwards, the acuminations sometimes accentuated by reflexions of the subapical margins, the margins entire or with indistinct indications of small teeth.

COLLECTOR: T. D. A. Cockerell.

FORMATION AND LOCALITY: Miocene shale, Florissant, Colorado (Station 14).

Type specimen in the Museum of the New York Botanical Garden.

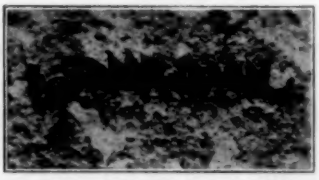

FIG. 1. JUNGERMANNIOPSIS COCKERELLII Howe & Hollick

The one fragment, upon which the genus and species are based, is about 12 or 13 mm. long and evidently lies on its side. The specimen shows a possible forking of the stem near the apex, with one branch ascending and the other descending, but the descending part is probably only a collection of roothairs. Among the living Hepaticae, the pointed, antically secund leaves of *Jungermanniopsis* suggest the widely distributed *Herberta adunca* (Dicks.) S. F. Gray; but there is no indication that the leaves are bilobed as in the genus *Herberta*. In its antically secund leaves, it resembles also such leafy Hepaticae as *Jamesoniella autumnalis* (DC.) Steph. and certain species of *Nardia*, but in the form and looser disposition of the leaves it is very different from any of these. The possible presence of smaller

ligulate or lanceolate lateral leaves might, if fully substantiated, result in placing the plant with the Musci rather than with the Hepaticae. But the small size and general habit of the organism suggest affinities with the Jungermanniaceae rather than with the Musci. The specific name is in honor of Mr. T. D. A. Cockerell, the collector.

A new genus of fossil Liliaceae

T. D. A. COCKERELL

(WITH ONE TEXT FIGURE)

In 1873* Lesquereux reported a singular fossil from the Miocene shales of Florissant, Colorado, as *Ophioglossum Alleni*. In 1878 he figured it† and assigned it to the genus *Salvinia*, on account of its close resemblance to Heer's European fossil *S. reticulata*. Hollick‡ gave a new figure, and placed the plant in the genus *Tmesipteris*, where it remains in Knowlton's Catalogue.

This so-called *Tmesipteris Alleni* is common in the Florissant shales but has remained an unsolved problem. A number of years ago, at the British Museum, I showed specimens to Dr. A. C. Seward and Dr. A. G. Nathorst. We could all agree that there was no relationship with *Tmesipteris*, but it was impossible to even guess at the true position of the species. Seward,§ when publishing on the subject later, rejected the reference to *Tmesipteris*, without being able to suggest another alternative. In 1913,¶ to avoid perpetuating an obvious error, I referred the plant to *Carpolithes*, supposing it to represent some sort of fruiting body. No seeds could ever be seen, although the appearance suggested a flattened pod; but the published figures failed to show a thickening on the midrib, a little beyond the middle. In a very good specimen found at Florissant in November, 1921, there is a definite body at this point, with a diameter of nearly 3 mm. It looks like a small berry, with the contents extruded (FIG. 1, C).

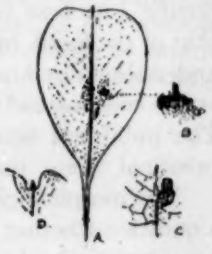

FIG. 1. BRACHYRUSCUS ALLENI Cockerell
A. Cladode bearing pistillate flower. B. flower, enlarged. C. Fruit on a mature cladode. D. Emarginate apex of a mature cladode.

Probably the riddle would never have been solved but for the discovery of a younger specimen in the Florissant shales,

* For bibliographical references see Knowlton, Mesozoic and Cenozoic plants of North America. U. S. Geological Survey Bull. 696: 626. 1909

† Tertiary Flora, *pl. 5, f. 11*. 1878.

‡ Bull. Torrey Club. **21**: *pl. 205, f. 12*. 1894.

§ Fossil plants **2**: 25. 1910.

¶ Am. Jour. Sci. VI. **36**: 500.

at Station 14. This (FIG. 1, A, B) shows that we have to do neither with a leaf, frond nor pod, but with a cladode. Attached to the midrib is an indistinct mass, presumably a thin bract, upon which can be seen a dark object (FIG. 1, B), which seems to agree very closely with the flower of *Ruscus*. The pistil is erect and distinct. The plant is dioecious, and the staminate flower is as yet unknown. At first I thought there might be two flowers, but the supposed second one is, I believe, part of the midrib.

As I could not identify the plant with *Ruscus*, I consulted Dr. Britton, who very kindly sent me material of *Phyllonoma ruscifolia* Willd. and *Ruscus hypoglossum* L. It was at once apparent that the fossil had nothing to do with *Phyllonoma*, but returning to *Ruscus* as the only alternative, I was able to recognize close morphological similarity. The genus *Ruscus* is today limited to a few Palaearctic species, with lanceolate to ovate sharply pointed cladodes. The apical points are stiff and sharp, as any one who has handled butcher's broom will testify. At first sight the venation seems quite different from that of the fossil, but if we imagine the *Ruscus* cladode broadened and abbreviated until the principal veins are nearly or quite transverse instead of longitudinal, the correspondence is exact. The published figures of the fossil do not show that there are principal veins, just as in *Ruscus*.

The morphological correspondence is so exact that it becomes a question whether the fossil can be referred to *Ruscus*. However, considering the broad form of the cladodes, with truncate or emarginate, mucronate apex, the essentially transverse veins, and the remoteness in time and space, it appears justifiable to establish a distinct genus, *Brachyruscus*, the species becoming *Brachyruscus Alleni* sp. nov.* Whether Heer's *Salvinia ret-*

* Dr. Hollick writes that he is not convinced that the flowering cladode, which I have figured and described, belongs to the same plant as the "*Tmesipteris*" *Alleni*. I had considered the possibility of there being two different things, and am personally entirely convinced that all the specimens belong to a single species. However, I will designate the flowering specimen as the type of the genus and of a species which I will name *B. Alleni*. This name will remain valid if my view is correct, only *B. Alleni* Cockerell will be a synonym of *B. Alleni* (Lesq.) Cockerell. If it should be decided that there are two quite different plants, *B. Alleni* Cockerell will still stand, only to fall in case some author considers that two distinct species of *Brachyruscus* are present.

iculata is congeneric, it is impossible to say; the reticulation, as figured, looks different.

Ruscus today has its western limit in Madeira. The insular form, which I saw in cultivation in Funchal, is regarded as a race of *R. hypophyllum* L., but is perhaps specifically distinct. The name *R. latifolius* Lowe is preoccupied by Rafinesque.

BRACHYRUSCUS gen. nov.

Cladodes pyriform to suboval in outline, with a strong midrib; apex obtuse, emarginate, with a stiff mucro representing the end of the midrib or morphological apex; principal veins diverging from the midrib approximately at right angles, except toward the apex, where they form angles of about 45 degrees; principal veins connected by veinlets, forming a coarse reticulation of quadrilateral or kite-shaped areas; inflorescence borne on midrib as in *Ruscus*, with apparently a single flower, which (as imperfectly preserved) presents no characters to differentiate it from *Ruscus*. Type the following:

Brachyruscus Alleni sp. nov.

Cladode in the type specimen broad-pyriform, with tapering base, length about 18 mm. and breadth 12 mm. [in my opinion the larger cladodes (length about 31 mm. and breadth 20 mm.), with dark and distinct venation, belong to the same species]: stems unknown but doubtless woody.

INDEX TO AMERICAN BOTANICAL LITERATURE

1921

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in the broadest sense.

Reviews, and papers that relate exclusively to foresty, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

This Index is reprinted monthly on cards, and furnished in this form to subscribers at the rate of three cents for each card. Selections of cards are not permitted; each subscriber must take all cards published during the term of his subscription. Correspondence relating to the card issue should be addressed to the Treasurer of the Torrey Botanical Club.

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